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This was a DOD-University Research Instrumentation grant and a complete optical fiber draw facility from Special Gas Control, England, and auxillary equipment was purchased for the fiber characterization laboratory.

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Final Report

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Building 410
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For the Grant AFOSR-87-0020

OPTICAL FIBER SCIENCE AND TECHNOLOGY: NOVEL FIBERS AND FIBER SENSORS

Period: October 1, 1986 to February 29, 1988 (with extension)

from

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Final Report: Grant AFOSR-87-0020

Final Report: OPTICAL FIBER SCIENCE AND TECHNOLOGY: NOVEL FIBERS AND FIBER SENSORS

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Division of Engineering, Providence, R.I. 02912

Within the Division of Engineering at Brown University there has been established a Laboratory for Lightwave Technology that involves a multidisciplinary research in a variety of topics. (See Appendix). This equipment grant has permitted the purchase of a complete optical fiber draw facility from Special Gas Control, England, and auxillary equipment for our fiber characterization laboratory.

The draw tower has been erected in a specially prepared laboratory in the basement of the Prince Engineering Laboratory at Brown University. It is a 7.8 m automated tower with a 20 kw carbon induction furnace, and sufficient room for two uv coating stages, or a uv coating stage, and a thermal curing stage. The tower installation took perhaps somewhat more time than initially anticipated, largely due to difficulties in the site preparation. The tower itself has been installed on a reinforced concrete pad, with appropriate vibration isolation. For about six months, we have been gaining experience in the use of the tower, and have been drawing kilometer lengths of fiber that range in diameter from 50 μ to 250 μ with a tolerance of the order of a few μ. In anticipation of expanding the coating capabilities of our draw tower, we have also purchased a vacuum system for use with radio frequency sputtering on-line on the tower. This will be particularly useful for ceramic coated fibers in the study of the behavior of fiber strengthened composite materials.

One of the programs we have been actively pursuing with fibers drawn from preforms made in our laboratory, is that of second harmonic frequency generation. This is in conjunction with our research of novel dopants in optical fibers. We have initiated a program of cooperative research with Major J. Rotger, Frank J. Seiler U.S. Air Force Research Laboratory, Colorado Springs, and with Dr. Ulf Osterberg, a member of Prof. Stegeman's group at the University of Arizona, Optical Science Center. Dr. Osterberg, whom I recently visited, is carrying on some of his second harmonic experiments with phosphorus doped silica based fibers supplied by our laboratory. Dr. Osterberg is also setting up

some experiments in conjunction with Major Rotger in the area of frequency doubling, and fibers from our facility are being used in this effort. The goal will be to increase the efficiency of this process, and to understand the basic mechanism responsible for this unexpected phenomenon. To this latter end, we have already obtained NMR spectra of our phosphorus doped fibers, and hope to obtain sufficient lengths of Nd:YAG irradiated fibers from Dr. Osterberg at the University of Arizona to use in Prof. Bray's (Department of Physics, Brown University) NMR facility. This may provide some insight into the details of the mechanism responsible for the breaking of the symmetry that permits second order harmonic generation in an amorphous glass.

Both the draw facility and the characterization equipment purchased with this grant have been indispensible to the continuance of this research program.